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Implementing nuclear non-proliferation in Finland

Regulatory control, international cooperation and the Comprehensive Nuclear-Test-Ban Treaty

Annual report 2010

Olli Okko (ed)

Säteilyturvakeskus
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Executive summary

Regulatory control of nuclear materials (nuclear safeguards) is a prerequisite for the peaceful use of nuclear energy in Finland. In order to uphold the Finnish part of the international agreements on nuclear non-proliferation – mainly the Non-Proliferation Treaty (NPT) – this regulatory control is exercised by the Nuclear Materials Section of the Finnish Radiation and Nuclear Safety Authority (STUK).

Nuclear safeguards are applied to all materials and activities that can lead to the proliferation of nuclear weapons or sensitive nuclear technology. These safeguards include nuclear materials accountancy, control, security and reporting of nuclear fuel cycle related activities. The main parties involved in a state nuclear safeguards system are the facilities that use nuclear materials – often referred to as "license holders" or "operators" – and the state authority. A license holder shall take good care of its nuclear materials and the state authority shall provide the regulatory control to ensure that the license holder fulfils the requirements at the facility site. The control of non-nuclear technology holders and suppliers to ensure the non-proliferation of sensitive technology is a growing global challenge for all stakeholders. In the Finnish legislation all these stakeholders are dealt with as users of nuclear energy.

STUK maintains a central nuclear materials accountancy system and verifies that nuclear activities in Finland are carried out according to the Finnish Nuclear Energy Act and Decree, the European Union's (EU) legislation and international agreements. This task is carried out to guarantee that Finland can assure itself and the international community of the absence of undeclared nuclear activities and materials. In addition to this, the International Atomic Energy Agency (IAEA) evaluates the success of the state safeguards system and the European Commission (EC) participates in safeguarding the materials under its jurisdiction.

Finland has a significant nuclear power production, but the related nuclear industry is rather limited. About 99.8% of the nuclear materials (uranium, plutonium) in Finland reside at the nuclear power plants (NPP) in Olkiluoto and Loviisa. Most of the remaining 0.2% is at the VTT research reactor in Otaniemi, Espoo. Additionally, there are a dozen minor nuclear material holders in Finland.

The construction project in Olkiluoto for the final disposal facility for spent nuclear fuel does not involve any actual nuclear material yet, but nuclear safeguards are applied to the facility site already, to prepare for effective future safeguards. Thus the basic technical characteristics (BTC) of the final disposal facility were provided to the European Commission and to the IAEA. Accordingly, the non-nuclear buildings were declared as a site under the Additional Protocol (AP) to the IAEA and the first IAEA and Commission inspections were carried out in 2010.

The construction project for the third reactor at the Olkiluoto NPP site is being provided turnkey by the consortium responsible for the delivery. The nuclear technology and instrumentation of the new facility are being imported and installed. The import licenses are reviewed as applicable to ensure the peaceful use of the technology. The IAEA and the Commission made their first site visits to the construction site prior to the installation of safeguards instrumentation and fuel delivery.

New nuclear facilities were authorised during 2010. The construction of new nuclear power reactors at two sites and the expansion of the geological repository in Olkiluoto were endorsed by the Finnish Parliament on 1 July 2010. These include the fourth reactor at the Olkiluoto power plant; a new nuclear power plant site, to be announced later by the applicant, the new power company Fennovoima; and the expansion of the geological repository to cover the volume applied for the spent fuel from the new Olkiluoto reactor. The new applicant Fennovoima is requested to submit a construction license application within 5 years and a plan for its waste management within 6 years time. The safeguards systems for these new facilities shall be designed in accordance with facility design.

Two new material balance areas in the front-end of the nuclear fuel cycle were assigned during the year. The bioheapleaching technique developed for large nickel deposits makes the extraction of other metals from low grade ore economically viable at the Talvivaara mine. Therefore, uranium may be economically extracted at the site as one of the by-products of nickel. The Harjavalta nickel refinery applied for the licence to refine the Talvivaara nickel products. Uranium residuals will be extracted from the nickel. Industrial scale mineral processing may start in 2011 after nuclear licensing. The environmental impact assessments and public hearings regarding the authorisation of all these new facilities and activities were discussed in the media during 2010 making this one of the topics of the year.

The results of STUK's nuclear safeguards inspection activities in 2010 continued to demonstrate that Finnish licence holders take good care of their nuclear materials. There were no indications of undeclared nuclear materials or activities and the inspected materials and activities were in accordance with the licence holders' declarations. STUK remarked on the nuclear safeguards systems of two of the licence holders in 2010, setting required actions to comply with the descriptions of their procedures and responsibilities for nuclear material accountancy and control systems.

The number of the inspection days of the international inspectorates is reduced significantly owing to the state-level integrated safeguards approach for Finland in force since 2008. Neither the IAEA nor the EC made any remarks nor did they present any required actions based on their inspections. By their nuclear materials accountancy and control systems, all licence holders enabled STUK to fulfil its own obligations under the international agreements relevant to nuclear safeguards.

The human resources development during 2010 was focused on nuclear forensics and security issues related to nuclear materials control. STUK and the Finnish Customs continued the joint multi-year border monitoring development project. The project covers updating technical equipment and operational procedures, and customs officers training. The competences at the Nuclear Materials Section were strengthened by one dissertation and one graduation.

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is one of the elements of the global nuclear non-proliferation effort. STUK has two roles in relation to the CTBT: STUK operates the Finnish National Data Centre (FiNDC) and one of the radionuclide laboratories (RL07) designated in the CTBT. The main task of the FiNDC is to inspect data received from the International Monitoring System (IMS) and to inform the national authority, the Ministry for Foreign Affairs, about any indications of a nuclear weapons test. The FiNDC falls under the non-proliferation process in STUK's organisation, together with the regulatory control of nuclear materials.

A major goal of all current CTBT related activities is the entry into force of the CTBT itself. An important prerequisite for such positive political action is that the verification system of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is functioning and able to provide assurance to all parties that it is impossible to make a clandestine nuclear test without getting detected. The FiNDC is committed to its own role in the common endeavour so that the verification system of the CTBTO can accomplish its detection task.

Contents

1 Nuclear non-proliferation implementation in Finland

Nuclear non-proliferation is a prerequisite for the peaceful use of nuclear materials and nuclear energy, globally. In order for Finland to have a nuclear industry, most of which consists of nuclear energy production, it must be ensured that nuclear materials, equipment, and technology are used only for their declared, peaceful purposes. The basis for nuclear safeguards is the national system for the regulatory control of nuclear materials and activities. Nuclear safeguards are an integral part of nuclear safety and nuclear security and they are applied both to large and medium-size nuclear industry and to small-scale nuclear material activities. Along with the safeguards, the regulatory process for nuclear non-proliferation includes transport control, export control, border control, international cooperation and conventions, and monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

1.1 International safeguards agreements and national legislation

Nuclear safeguards are based on international agreements, the most important and extensive of which is the Treaty on the Non-Proliferation of Nuclear Weapons (Non-Proliferation Treaty, NPT). The Treaty Establishing the European Atomic Energy Community (Euratom Treaty) is the basis for the nuclear safeguards system of the European Union (EU). Finland is bound by both of these treaties, and also has several bilateral agreements in the area of peaceful use of nuclear energy. Upon joining the EU, Finland's bilateral agreements with Australia, Canada and the USA were partly substituted by the corresponding Euratom agreements (see Appendix 3 for the relevant legislation).

Finland was the first state where an INFCIRC[1]/153-type nuclear Safeguards Agreement with the IAEA entered into force (INFCIRC/155, 9 February 1972). When Finland joined the EU (1 January 1995), this agreement was suspended and subsequently the Safeguards Agreement between the non-nuclear weapon Member States of the EU, the Euratom, and the IAEA (INFCIRC/193) entered into force in Finland, on 1 October 1995. Finland signed the Additional Protocol (AP) to the INFCIRC/193 in Vienna on 22 September 1998, with the other EU Member States, and ratified it on 8 August 2000. The Additional Protocol entered into force in April 30, 2004, when all the EU Member States had ratified it. The scope and mandate for Euratom nuclear safeguards are defined in the European Commission Regulation No. 302/2005.

After Finland joined EU as a Member State, and therefore joined the Euratom nuclear safeguards, a comprehensive national safeguards system was still maintained. The basic motivation for this is the responsibility assumed by Finland for its nuclear safeguards and nuclear security under the obligations of the NPT.

The national nuclear safeguards derive their mandate and scope from the Finnish Nuclear Energy Act and Decree. These were amended during 2008 as a result of the general constitution-based renewal of the Finnish nuclear legislation system. The operator's obligation to have a nuclear material accountancy system and the right of STUK to oversee the planning of and generation of design information for new facilities was introduced from STUK regulations to the Decree.

[1] INFCIRC = IAEA Information Circulars

As stipulated by the Act, STUK issues detailed regulations on safety and security (the YVL Guides) that apply to the use of nuclear energy. The YVL Guides most relevant to nuclear safeguards are:

- Control of nuclear fuel and other nuclear materials required in the operation of nuclear power plants (Guide YVL 6.1)
- The national system of accounting for and control of nuclear materials (Guide YVL 6.9)
- Reports to be submitted on nuclear materials (Guide YVL 6.10).

All STUK YVL Guides are under renovation. The guides relevant to safeguards shall be merged into one joint new guide. The draft version has already been communicated to the stakeholders. The new guides shall be issued by the end of 2011.

Nuclear materials control applies to:

- nuclear material (special fissionable material and source material)
- nuclear dual use items (non-nuclear materials, components, equipment and data suitable for producing nuclear energy or nuclear weapons as specified in INFCIRC/254, Part 1)
- licence holders' activities, expertise, preparedness and competence
- R&D activities related to the nuclear fuel cycle
- nuclear security, and
- safeguards for the final disposal of spent nuclear fuel.

1.2 Parties of the Finnish nuclear safeguards system

The main parties involved in the Finnish nuclear safeguards system are the authorities and the licence holders. Undistributed responsibility for the safety, security and safeguards of the use nuclear energy is on the licence holder. It is the responsibility of STUK as the competent state authority to ensure that the license holders comply with the requirements of the law and the nuclear safeguards agreements. To complement the national effort, international control is necessary to demonstrate credibility and the proper functioning of the national safeguards system.

1.2.1 Ministries

The Ministry for Foreign Affairs (MFA) is responsible for national non-proliferation policy and international agreements. The MFA is responsible for the export licensing of nuclear materials and other nuclear dual use items including sensitive nuclear technology. The Ministry of Employment and the Economy (MEE) is the highest authority for management and control of nuclear energy. MEE is responsible for legislation related to nuclear energy and it is also the competent authority mentioned in the Euratom Treaty. Also other ministries, such as the Ministry of the Interior and the Ministry of Defence contribute to the efficient functioning of the national nuclear safeguards system.

1.2.2 STUK

According to the Finnish nuclear legislation, STUK is responsible for maintaining the national nuclear safeguards system in order to prevent proliferation of nuclear weapons. STUK regulates the license holders' activities and ensures that the obligations of international agreements concerning peaceful use of nuclear materials are met. Regulatory control by STUK includes the possession, use, production, transfer (national and international), handling, storage, transport, export and import of nuclear material and nuclear dual use items. STUK is in charge of Finland's approval and consultation process for IAEA and European Commission inspectors. STUK approves an inspector as long as there are no such issues related to the person in question that might adversely affect nuclear safety or security at Finnish facilities or the non-proliferation of nuclear weapons. The new inspector requests are sent for comments to the operators that hold construction or operating licenses for nuclear facilities. If STUK cannot approve an inspector, it assigns the approval process to the Ministry of Employment and the Economy.

Nuclear safeguards by the Nuclear Materials Section of STUK (see Figure 1 for the organisational chart and Figure 12 for the staff) cover all typical measures of a State System of Accounting for and Control of Nuclear Materials (SSAC), and many other activities besides. STUK reviews the license holders' reports (operational notifications, inventory reports), inspects their accountancy, facilities and transport arrangements on site, and performs system audits. Office work constitutes 90% of the inspection effort. STUK runs a verification programme for nuclear activities to assess the completeness and correctness of the declarations by the licence holders. Nuclear safeguards on the national level are closely linked with other functions of nuclear materials control and non-proliferation: licensing, export control, border control, transport control, combating illicit trafficking, the physical protection of nuclear materials, and monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT) – all duties of the STUK Nuclear Materials Section. Nuclear safety and particularly nuclear security objectives are closely complemented by safeguards objectives. Therefore, the research, development and regulatory units in the fields of safety, security and safeguards at STUK cooperate under the non-proliferation framework.

1.2.3 License holders

Essential parts of the national nuclear safeguards system are the licence holders, in nuclear terminology often called the operators. They perform key functions of the national safeguards system: control of the authentic source data of their nuclear materials and accountancy of nuclear material at the facility level for each of their material balance areas (MBA). Each license holder has to operate its safeguards system according to its own nuclear materials handbook. The handbook is a part of the facility's quality system and is reviewed and approved by STUK.

With the basic technical characteristics (BTC) submitted by a license holder as groundwork, the European Commission shall adopt particular safeguards provisions (PSP) for that license holder. PSP are to be drawn taking into account operational and technical constraints and in close consultation with both the person or undertaking concerned and the relevant member state. Until PSP are adopted, the person or undertaking shall

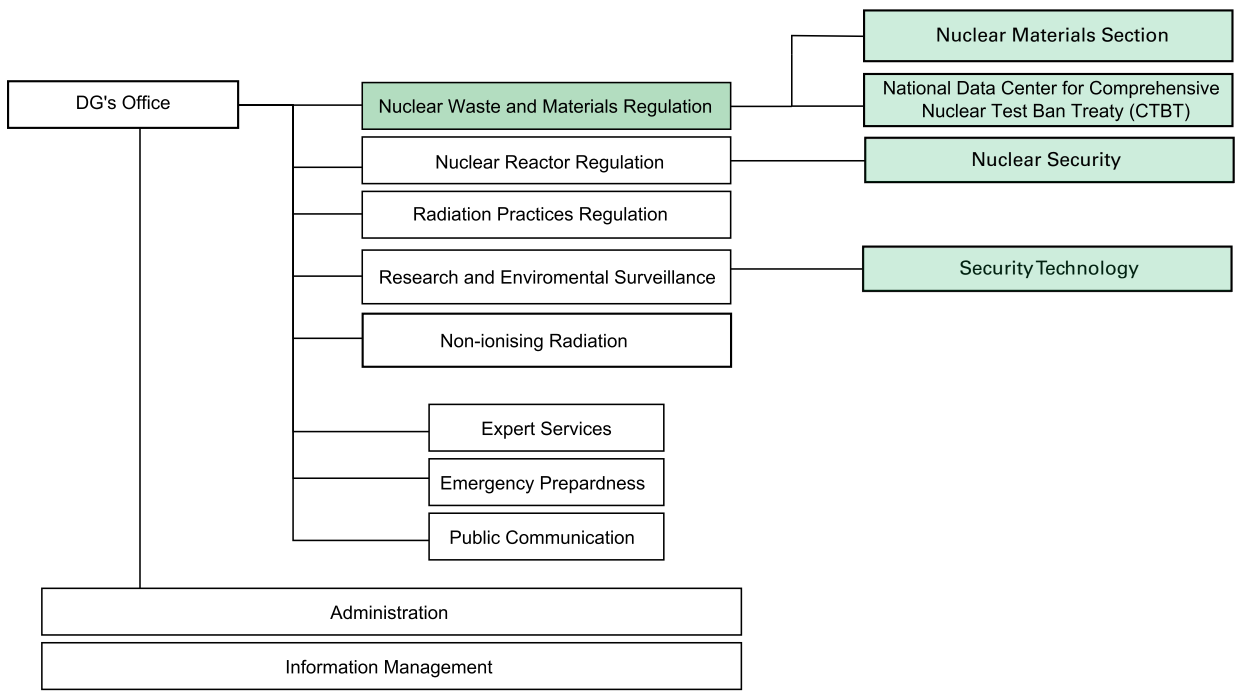

Figure 1. Several departments and independent units of STUK cooperate under the non-proliferation framework.

apply the general provisions of the Commission regulation No 302/2005.

99.8% of all nuclear materials in Finland reside at the nuclear power plants (NPP). The nuclear material (uranium, plutonium) amounts in Finland in 1992–2010 are presented in Figures 2 and 3.

Fortum (MBA WL0V)

Fortum is a partly state-owned energy company, one of the largest in the Nordic countries. Fortum operates power plants of several types, nuclear among others.

The nuclear power plant of Fortum Power and Heat is located on the Hästholmen Island in Loviisa on the south-east coast of Finland. This first NPP to have been built in Finland hosts two power reactor units: Loviisa 1 and Loviisa 2. Loviisa 1 started its electricity production in 1977 and Loviisa 2 in 1980. These two units share common fresh and spent fuel storages and for nuclear safeguards accountancy purposes the whole NPP is counted as one material balance area (MBA code WL0V). The electricity generated by the Loviisa NPP constitutes ca. 10% of the whole electricity production in Finland.

Most of the fuel for the Loviisa NPP has been imported from the Soviet Union / Russian Federation. The spent fuel of the Loviisa NPP was returned to the Soviet Union / Russian Federation until 1996 and since then the spent fuel has been stored in the interim storage due to a change in the Finnish nuclear legislation, which today forbids, in general, import and export of nuclear waste including spent fuel.

The Loviisa NPP site (SSFLOV1), as per the requirements of the Additional Protocol, comprises the entire Hästholmen Island and extends to the main gate on the continent. Particular Safeguards Provisions for the Loviisa NPP, which define the European Commission's nuclear safeguards procedures for the facility, have been in force since 1998. The Facility Attachment of the Safeguards

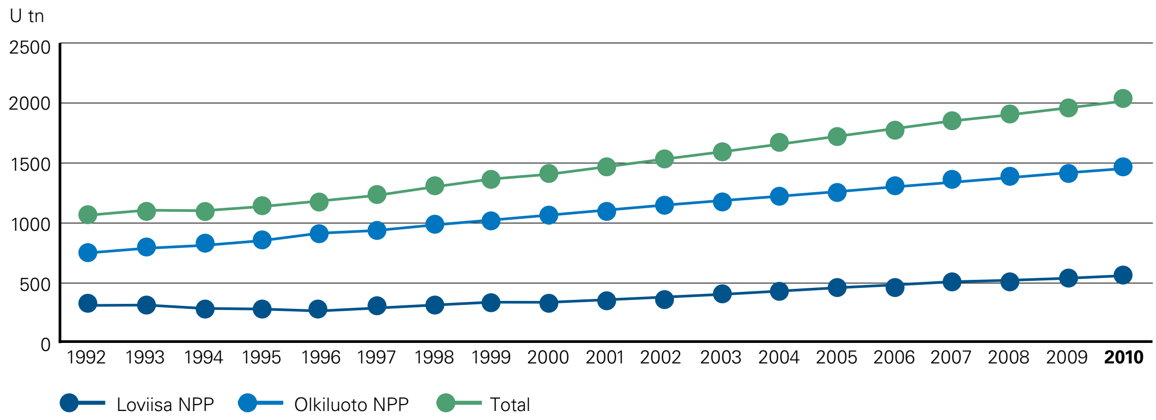

Figure 2. Uranium amount in Finland in 1992–2010.

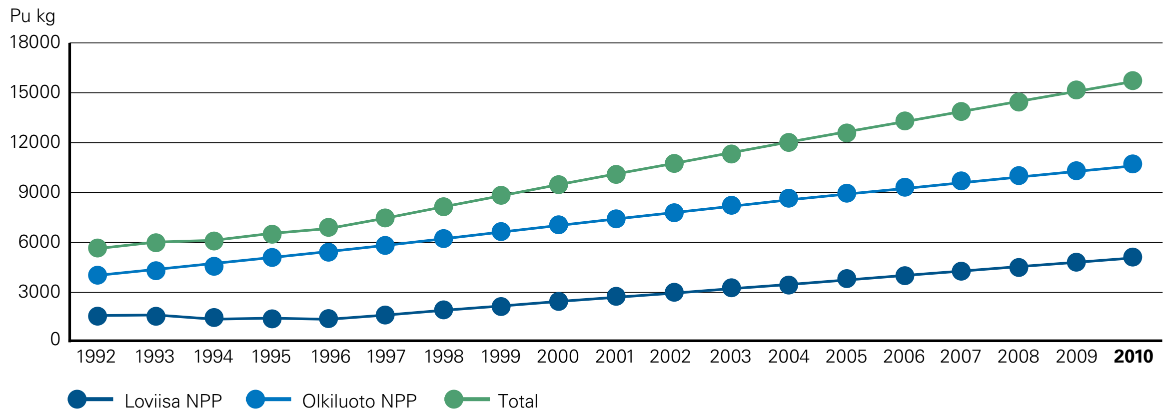

Figure 3. Plutonium amount in Finland in 1992–2010.

Agreement INFCIRC/193 has not been prepared for the Loviisa NPP.

Teollisuuden Voima (MBAs W0L1, W0L2, W0LS and W0L3)

Teollisuuden Voima Oyj (TVO) owns and operates a nuclear power plant on the Olkiluoto Island in Eurajoki on the west coast of Finland. The Olkiluoto NPP consists of two nuclear power reactor units, Olkiluoto 1 and Olkiluoto 2, and an interim spent fuel storage. Olkiluoto 1 was connected to the electricity grid in 1978 and Olkiluoto 2 in 1980. The Olkiluoto NPP contributes ca. 16% of the whole electricity production in Finland. At the Olkiluoto NPP there are three active material balance areas (MBA codes W0L1, W0L2, W0LS).

Presently, the uranium in TVO's nuclear fuel is mainly of Australian, Canadian and Russian origin. This uranium is enriched in the Russian Federation or in the EU and the fuel assemblies are manufactured in Spain and Sweden.

The Finnish Government granted a licence for constructing a new nuclear reactor, Olkiluoto 3, on 17 February 2005. As a part of the licensing process, TVO's plan for arranging the necessary measures for preventing proliferation of nuclear weapons was approved by STUK. The construction and assembly work of the reactor unit is under way. The European Commission has assigned the MBA code W0L3 for Olkiluoto 3. The initial criticality of the reactor is scheduled for 2013.

New nuclear facilities were granted by the Government on 6 May 2010. One of these was the Olkiluoto 4 reactor. The geotechnical site characterisation works at the Olkiluoto 4 site began in 2010. The selection of the vendor and the supply organisation shall take place in the near future.

TVO owns most of the area of the Olkiluoto Island, but the NPP site (SSFOLK1), as per the requirements of the Additional Protocol, comprises currently the fenced areas around the reactor units, the spent fuel storage and the storage for low and intermediate level waste as well as the Olkiluoto 3 construction site. Particular Safeguards Provisions for the Olkiluoto NPP have been in force since 2007. The Facility Attachment of the Safeguards Agreement INFCIRC/193 has not been prepared for the Olkiluoto NPP.

VTT FiR1 research reactor (MBA WRRF)

Small amounts of nuclear materials are located at facilities other than nuclear power plants. The most significant of those facilities is the VTT research reactor FiR1 (MBA code WRRF) in Otaniemi, Espoo. The research reactor was the first nuclear reactor built in Finland. It reached criticality on 27 March 1962.

Particular Safeguards Provisions that define the European Commission's nuclear safeguards procedures for the facility have been in force for VTT FiR1 from 1998. The Facility Attachment of the Safeguards Agreement INFCIRC/193 has not been prepared for the research reactor.

The VTT FiR1 site (SSFVTT1), as per the requirements of the Additional Protocol, consists of the whole building around the research reactor, although there are non-nuclear companies and university premises in the same building.

STUK (MBA WFRS)

Small quantities of nuclear materials are stored by the Finnish Radiation and Nuclear Safety Authority (STUK), mainly material no longer in use and hence taken into STUK's custody. STUK was founded in 1958 and is located at its current premises in Roihupelto, Helsinki since 1994. The STUK MBA (WFRS) consists of the STUK headquarters and the "Central interim storage for small-user radioactive waste" at the Olkiluoto NPP site.

The STUK site (SSFSTUK), as per the requirements of the Additional Protocol, consists of the whole building where STUK's headquarters are located in Helsinki, but non-STUK premises in the building are excluded. The storage at Olkiluoto is included in the NPP's site declaration.

The University of Helsinki, Laboratory of Radiochemistry (MBA WHEL)

The Laboratory of Radiochemistry at the University of Helsinki (HYRL) uses small amounts of nuclear materials. HYRL is located at the Kumpula university campus in Helsinki.

The HYRL site (SSFHYRL), as per the requirements of the Additional Protocol, comprises the whole building that hosts the laboratory.

OMG Kokkola Chemicals (MBA WKK0)

The OMG Kokkola Chemicals facility does not use nuclear materials as such. However, the by-products of their cobalt purification process contain uranium, which qualifies these by-products as nuclear material. OMG Kokkola Chemicals has an operation license for production, storing and handling nuclear material. OMG Kokkola Chemicals is located on the west coast of Finland.

Other nuclear material holders

There are about 10 minor nuclear material holders in Finland. One of them is an actual material balance area: University of Jyväskylä, Department of Physics (JYFL, MBA code WDPJ), but in fact the nuclear material in JYFL has been derogated and exempted by the European Commission and the IAEA. Other minor nuclear material holders are members of a Catch-All-MBA (CAM), for purposes of international nuclear safeguards. Most of these have depleted uranium as radiation shielding material.

New operators and new MBAs

The Talvivaara mine announced on 9 February 2010 its interest to investigate the recovery of uranium as a separate product from its sulphide ore body. Moreover, the Norilsk Nickel Harjavalta nickel refinery has prepared itself for the processing of the Talvivaara Sotkamo Ltd. nickel products including processing and separation of uranium. Both companies have submitted their licence applications as well as their BTC to the European Commission. The processing of the uranium products is expected to take place in 2011. The MBA code WTAL is assigned for the future uranium mine at Talvivaara, and the MBA code WNNH for the nickel refinery at Harjavalta. The progress in is described in detail in Chapter 2 – one of the major themes of the year.

New nuclear facilities were granted by the Government on 6 May 2010. One of these was the nuclear power plant for the new applicant Fennovoima. The company has two options to locate its plant and the reactor(s). The construction license is expected to be submitted in five years. This major milestone in Finnish nuclear history is also one of the themes of the year 2010.

Posiva (MBA W0LF)

Posiva Oy is the company responsible for the final disposal of spent nuclear fuel in Finland. It is owned by TVO and Fortum. Posiva has been excavating an underground rock characterisation facility called "Onkalo" in Eurajoki since 2004, and thus preparing for the construction of the final disposal facility. While neither a nuclear license holder nor a nuclear material holder yet, Posiva and its activities are highly relevant to the national safeguards system because Posiva is foreseen to develop a new type of facility, the geological repository, where the nuclear material cannot be re-verified once it has been encapsulated and emplaced. In the IAEA safeguards approaches it has been suggested that the geological formation should be under safeguards during the whole lifetime of the underground facility. Therefore, Posiva has been required to develop a non-proliferation handbook, such as a nuclear materials handbook, to describe Posiva's safeguards procedures and reporting system already before becoming a nuclear material holder. The preliminary basic technical characteristics (BTC) have been provided and the European Commission has already assigned the MBA code W0LF for Onkalo. The facility without nuclear materials but having the BTC constitutes a site according to the Additional Protocol. The Posiva site (SSFPOS1) covers the fenced area around the buildings supporting the repository construction. The Decision-in-Principle of 6 May 2010 included the enlargement of the capacity of the disposal facility to include spent fuel disposal of its owners; i.e., as applied for the spent fuel of the Olkiluoto 4 reactor.

Other stakeholders

Non-nuclear technology holders and suppliers serving nuclear and other industry are obliged to take care that non-proliferation sensitive technology is not getting into the hands of unauthorized non-state actors and thereby contributing to proliferation of mass destruction means. The introduction of the Additional Protocol (1996) extended the scope of safeguards to the non-proliferation control of nuclear programmes and fuel cycle related activities in Member States around the world. Additionally, the United Nations Security Council Resolution

1540 (April 2004) requires every State to ensure that export controls, border controls, material accountancy and physical protection are efficiently taken care of and calls all States to develop appropriate ways to work with and inform industry and the public regarding their obligations. The control of non-nuclear technology holders and suppliers to ensure the non-proliferation and peaceful use of sensitive technology and dual-use items is a growing global challenge for all stakeholders.

Nuclear safeguards is commonly seen as the traditional nuclear material accountancy and reporting system, the main stakeholders of which are the international, regional and local authorities, and the operators. According to the enlarged non-proliferation regime and the amendments to the Finnish legislation, the companies having activities defined in the Additional Protocol or having customers for dual-use equipment abroad are under strengthened reporting requirements and export control.

IAEA regular inspections:

Facilities at nuclear power plants (NPP):

- *Physical Inventory Verification (PIV) / Design Information Verification (DIV) 1/year*
- *Random Interim Inspection (RII) at 24/48 h notification (at least 1/year)*

Spent fuel storages at NPPs

- *PIV/DIV 1/year*
- *RII at 2h i.e. Unannounced Inspection (UI)/48h notification (at least 1/year)*

Research reactor and locations outside facilities (LOF)

- *PIV/DIV 1/4–6 years*

New reactor (OL3), under construction

- *DIV and PIV later like at the NPPs*

Repository (Onkalo), under construction

- *PIV/DIV most likely as at spent fuel storages*

Complementary accesses at 2/24 h notification to verify declared activities or to detect undeclared activities.

1.3 IAEA and Euratom safeguards in Finland

The IAEA and the European Commission nuclear safeguards both have their separate mandates to operate in Finland. These two international inspectorates have agreed on cooperation (New Partnership Approach, NPA), which aims to reduce undue duplication of effort. Year 2009 introduced a significant change from the traditional safeguards procedures in Finland as the implementation of integrated safeguards began on 15 October 2008.

Integrated safeguards include traditional nuclear safeguards as per INFCIRC/193, and safeguards activities in accordance with the Additional Protocol, fitted together. While this should not lead to an increase in inspections, it should enable the IAEA to assure itself of the absence of undeclared nuclear activities in a state. In practice, the number of IAEA routine interim inspections decreases. In contrast to this, the IAEA will additionally perform 1–3 unannounced or short notice inspections per year in a state that has a number and type of nuclear installations that resembles the situation in Finland.

The operators are reporting to the European Commission as required per Commission Safeguards regulation. It is the Commission's task to audit the license holders' accounting and reporting systems. Both the Commission and STUK have increased preparedness for short notice and unannounced inspections and complementary access (abbreviated SNUICA). One of STUK's inspectors is daily prepared to attend, on alert, to a possible IAEA inspection.

The number of IAEA and Euratom routine inspections decreased in 2009 significantly as defined in the state-level safeguards approach for Finland, which was negotiated during 2007 and 2008 (see infobox). The time difference between the unannounced inspections at the two spent fuel storages (i.e. 2 hours for Loviisa and 48 hours for Olkiluoto) is due to the difference in the surveillance at the storages and reasonable access time for a STUK inspector. The notification time will be harmonised to 24 hours after the installation of new surveillance equipment at the Loviisa storage. The national State System of Accounting for and Control of Nuclear Material (SSAC) continues with annual routines with approximately 40 inspections, which enables the reduction in the effort of the international inspectorates.

1.4 Verified declarations for state evaluations

A state's declarations on its nuclear materials and activities are the basis for the state evaluation by the IAEA under the obligations of the Additional Protocol. In Finland, the state has delegated its responsibility for these declarations to STUK. STUK has been nominated a site representative, as per European Commission regulation No 302/2005. STUK collects, inspects and reviews the relevant information and then submits the compiled declarations timely to the Commission and the IAEA.

In Finland, there are six sites in the sense of the Additional Protocol: the two nuclear power plant (NPP) sites in Loviisa and Olkiluoto respectively, the geological repository site in Olkiluoto, and three minor sites: the Technical Research Centre of Finland (VTT), the Radiation and Nuclear Safety Authority (STUK) and the Laboratory of Radiochemistry at the University of Helsinki (HYRL). STUK reviews and verifies the correctness and completeness of the information about the sites provided by the stakeholders.

STUK reviews annually the information about research and development activities that might be eligible for declaration, as well as activities specified in Annex I of the Additional Protocol. STUK maintains the information on general plans related to the nuclear fuel cycle for the next 10 years and keeps account of the exports of specified equipment and non-nuclear materials, as listed in Annex II of the Additional Protocol.

Technical analysis methods are one tool for a state nuclear safeguards system to ensure that nuclear materials and activities within the state are in accordance with the licence holders' declarations and that there are no undeclared activities. Such methods can provide information on the identity of the nuclear materials and confirm that licence holders' declarations are correct and complete with respect to e.g. the enrichment of uranium, the burnup, and the cooling time of nuclear fuel. The technical analysis methods in use are non-destructive assay (NDA) and environmental sampling and satellite imagery.

STUK employs three NDA methods for verifying spent nuclear fuel. One method lends itself for rapid scanning, as the detector is mounted on the fuel transfer machine and the fuel elements can be measured from above the fuel pond without moving the elements. The other two methods, on the other hand, allow confirming with greater confidence the correctness of the declared burnup and the cooling time. With the most precise method, the absence of a fuel pin or pins from a fuel element can be discovered. STUK reports to the Commission and the IAEA about the NDA measurement campaigns.

All nuclear materials leave traces of their identity, source of origin and treatment. Safeguards environmental samples (ES) are used to investigate these traces, which provide further clarity in establishing whether the nuclear activities are in accordance with the declarations. In the Finnish nuclear safeguards system environmental samples are collected as surface swipes. The IAEA may collect independent environmental samples during its complementary access type of inspections.

Satellite imagery is applied to verify the site declaration pursuant to the Additional Protocol. Timely imagery is used to monitor different kinds of activities at the sites or elsewhere in Finland. STUK contributes to the work of satellite image analysts of the IAEA and the Commission.

1.5 Export/import control and licensing as elements of nuclear non-proliferation

According to the Finnish Nuclear Energy Act, in addition to nuclear materials also other nuclear fuel cycle related activities are under regulatory control. A license is required for possession, transfer and import of components, equipment, materials and technology suitable for producing nuclear energy (nuclear dual use items).

The list of these other items is based on Nuclear Suppliers' Group (NSG) Guidelines (INFCIRC/254 Part 1). The license holder is required to provide STUK annually with a list of the above mentioned items. Moreover, the export, import, and transfer of such items shall be reported to STUK.

Mining and mineral processing operations that aim to produce uranium or thorium are also under nuclear safeguards and regulatory nuclear safety control. Anyone carrying out these activities shall have a license and an accounting system to keep track of the amounts of uranium and thorium. A license is also required to export and import uranium or thorium ore, and these activities shall be reported to STUK and to the European Commission.

Finland's export control system is based on the EU Council Regulation (EC) No 428/2009 of 5 May 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items. The export of Nuclear Suppliers' Group (NSG) Part 1 and Part 2 items is regulated by the Finnish Act on the Control of Exports of Dual Use Goods. The licensing authority is the Ministry for Foreign Affairs. An authorisation is required to export nuclear items outside the European Union. A license is also required for EU internal transfers of NSG Part 1 items, excluding non-sensitive nuclear materials.

1.6 The regulatory control of transport covers nuclear materials

The requirements for the transport of radioactive material are set in the Finnish regulations on the transport of dangerous goods. The requirements are based on the IAEA safety standard Regulations for the Safe Transport of Radioactive Material, TS-R-1, and their purpose is to protect people, environment and property from the harmful effects of radiation during the transport of radioactive material. Based on these regulations, STUK is the competent national authority for the regulatory control regarding the transport of radioactive material.

In addition to the dangerous goods transport regulations, the Finnish Nuclear Energy Act sets specific requirements for the transport of nuclear material: a licence granted by STUK is needed for such a transport. Usually the transport licences are granted for a fixed period, typically for a few years. A transport plan and a security plan approved by STUK are mandatory for each transport of nuclear material. A certificate of nuclear liability insurance shall also be delivered to STUK before the transport. Furthermore, a package may be used for the transport of fissile nuclear material only after the package design has been approved by STUK.

1.7 STUK's contribution to international safeguards development

Nuclear non-proliferation is, by its nature, an international domain. STUK therefore actively participates in international nuclear safeguards related cooperation and development efforts.

STUK is a member of the European Safeguards Research and Development Association (ESARDA), and has nominated Finnish experts to its committees and most of the working groups. STUK participates in the ESARDA Executive Board meetings and the Presidency of ESARDA is currently held by a STUK representative.

The Standing Advisory Group on Safeguards Implementation (SAGSI) comprises a group of nuclear safeguards experts from the IAEA Member States, appointed by the IAEA Director General to advise on safeguards implementation issues. For the first half of 2010 one of the experts in this group was a STUK staff member.

Upon request by the IAEA, STUK's experts have contributed to the IAEA's international evaluation missions, such as the International SSAC Advisory Service (ISSAS). The ISSAS mission reviews State Systems of Accounting for and Control of Nuclear Materials (SSAC) and provides suggestions for improving them.

STUK keeps close contacts with the respective Nordic authority organisations. The development of the final disposal of spent nuclear fuel in geological repositories deepens the cooperation between Finland and Sweden.

1.8 The Comprehensive Nuclear-Test-Ban Treaty: a global technology-based non-proliferation tool

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is an important part of the international regime for the non-proliferation of nuclear weapons. The CTBT bans any nuclear weapon test explosions in any environment. This ban is aimed at constraining the development and qualitative improvement of nuclear weapons, including also the development of advanced new types of nuclear weapons.

The CTBT was adopted by the United Nations General Assembly, and was opened for signature in New York on 24 September 1996. The CTBT will enter into force after it has been ratified by the 44 states listed in its Annex 2. These 44 states participated in the 1996 session of the Conference on Disarmament and possess nuclear power or research reactors.

A global verification regime is being established in order to monitor compliance with the CTBT. The verification regime consists of the following elements: the International Monitoring System (IMS), a consultation and clarification process, on-site inspections and confidence-building measures.

Finland has signed and ratified the CTBT. In addition to complying with the basic requirement of the CTBT of not to carry out any nuclear weapons tests, Finland takes part in the development of the verification regime.

In the CTBT framework, the Finnish national authority is the Ministry for Foreign Affairs. STUK has two roles: STUK operates the Finnish National Data Centre (FiNDC) and one of the radionuclide laboratories (RL07) designated in the CTBT. The most important task of the FiNDC is to inspect data received from the IMS and inform the national authority about any indications of a nuclear weapons test. The radionuclide laboratory contributes to the IMS by providing support in the radionuclide analyses and in the quality control of the radionuclide station network. The third major national collaborator is the Institute of Seismology at the University of Helsinki, which runs an IMS seismology station (PS17 in Lahti), and provides analysis of waveform IMS data (Figure 4).

1.9 Nuclear safeguards and nuclear security have much in common

STUK is the national authority for the regulatory control of nuclear and radiological safety, security and safeguards. All these three regimes are means to a common end: protection of people, society, environment and future generations from the harmful effects of ionising radiation. From the definition of nuclear security, it is clear that the majority of the activities that aim at non-proliferation of nuclear weapons, nuclear materials and sensitive nuclear technology contribute to nuclear security. Moreover, such classical elements of security as physical protection of nuclear materials and facilities contribute to non-proliferation. Within STUK's organisation, some of its nuclear security related tasks fall – solely or partly – under the duties of the nuclear non-proliferation process and the Nuclear Materials Section:

- national system for the control of nuclear materials and nuclear dual use items facilitating international nuclear safeguards activities in Finland
- regulatory control of the transport of nuclear materials
- import and export control
- advice to the Finnish Customs on radiation monitoring at the borders, in concept development and technical specifications; training for Customs officers
- participation in the work of the international nuclear safeguards and nuclear security communities and working groups (IAEA, ESARDA, AQG, ITWG…)
- participation in STUK's response in cases of radiological or nuclear incidents
- advice to the Finnish Customs on interpretation of radiation detections at borders, more sophisticated on-site measurements and analyses in response to border monitoring alarms.

Comprehensive Nuclear-Test-Ban Treaty (CTBT) Status (31.12.2010)

- *CTBT Member States* 182
- *Total Ratifications* 153
- *Annex 2 Ratifications* 35

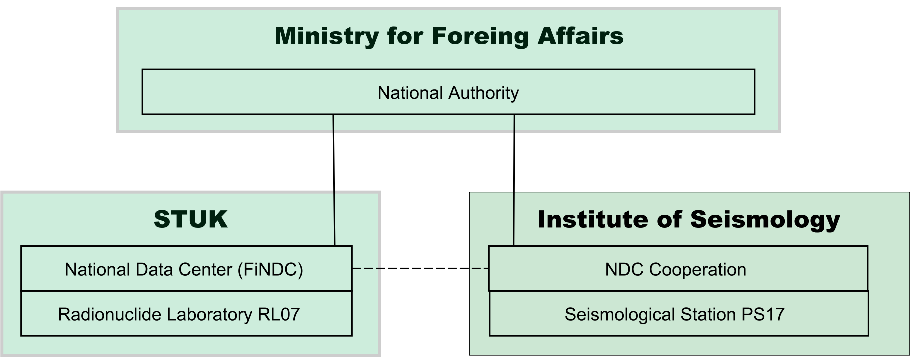

Figure 4. The Finnish CTBT organisation.

The Finnish regulatory system for nuclear security was audited by an IPPAS mission in 2009. One of the recommendations arising from the audit, namely the need for more detailed security requirements for minor holders of nuclear materials, was in the Nuclear Materials Section's area of responsibility. As a result, the new YVL Guide for nuclear materials control, under review since 2010 and expected to come into force in 2011, will contain more detailed security requirements for these minor holders.

2 Themes of the year 2010

2.1 Improvements in implementing Integrated Safeguards

STUK has organised information meetings on the effects of integrated safeguards for the nuclear power plant operators and preparatory trilateral meetings with the IAEA and the European Commission since 2007. During 2010 the implementation procedures were reviewed at four meetings. The new safeguards directors of the IAEA and the Commission visited Finland and the Olkiluoto construction sites and familiarised themselves with the current practises and the State Systems of Accounting for and Control of Nuclear Materials (SSAC). In the future the role of the SSAC may be strengthened, e.g. by enabling remote inspections and substituting the international inspectors to a certain extent. The current practice and future expectations of the Finnish SSAC were described in the extensive presentation of the Nuclear Materials Section at the IAEA safeguards symposium in November 2010.

2.2 The NPT Review Conference and the IAEA Safeguards Symposium – international highlights of the year 2010

The Status of the implementation of the Nuclear Non-Proliferation Treaty (NPT) was reviewed by the Member States in a Review Conference in May 2010 in New York. The Conference succeeded in generating a final consensus document. Additionally, the spirit and the focus were on planning commitments for the future. Non-Proliferation Treaty implementation should be further enhanced; the IAEA should implement Comprehensive Agreements efficiently; the Additional Protocol is appreciated as an efficient mechanism, but not approved as current standard. National safeguards and cooperation with the IAEA should be strengthened and all nuclear material in civilian use, including that in Nuclear Weapon States, should be subjected to IAEA safeguards. Peaceful use of nuclear energy should be supported e.g. via multinational approaches to fuel cycle services.

Ambitious objectives were set in New York. These included prompt negotiation of a new START agreement, abolishment of nuclear weapons for good, negative security assurances for non-nuclear weapon states, ratification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), negotiation of a Fissile Material Cutoff Treaty (FMCT), support to UN Secretary General's initiative for negotiation of a nuclear weapons convention. The Conference agreed on the action plan aimed at facilitating the negotiations for the Nuclear-Weapon-Free Zone (NWFZ) for the Middle-East.

The IAEA international safeguards symposium "Preparing for Future Verification Challenges" was held in November 2010 in Vienna. Issues discussed included IAEA safeguards challenges and opportunities for the IAEA itself and its Member States due to increased expectations and new roles and activities, the increasing interest in nuclear energy and the consequent expansion in nuclear trade, and the need to further enhance the Agency's capabilities to detect undeclared nuclear activities. In addition to the non-proliferation regime, the success of the NPT Review Conference and new challenges in disarmament, and ways to move to a nuclear-weapons-free world were in focus. STUK made a strong contribution by giving the opening statement "Change and Verify", by moderating two panel sessions, and by presenting two papers and several posters (see Figures 5–7). The Security Technology group of STUK won the best poster award in the Session for Indicators, Forensics and Environmental Sampling with their presentation of the position-sensitive detection system that uses the Particles And Non-Destructive Analysis (PANDA) device.

Figure 5. Presidents of ESARDA and INMM after giving opening statements at the IAEA Safeguards Symposium.

Figure 6. Ms. Martikka is moderating the session on state experiences on the implementation of integrated safeguards.

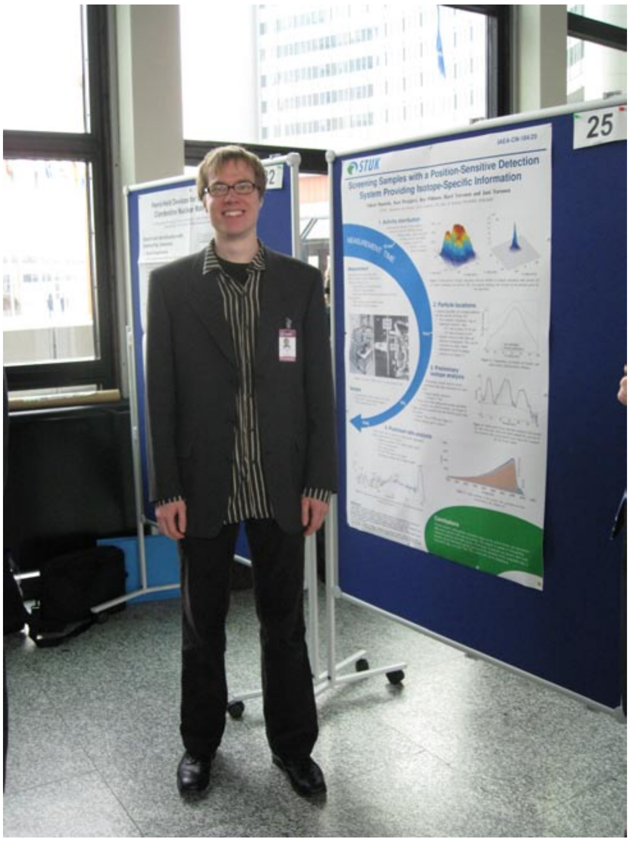

Figure 7. The award winning poster and the main author Sakari Ihantola.

2.3 Licenses for new power plants in Finland

Three power companies and the spent fuel management company submitted their applications during 2008 and 2009 for a Decision-in-Principle to construct new nuclear power plants in Finland. During 2009 STUK reviewed these applications for nuclear safety, security, safeguards etc. as defined in the Nuclear Energy Act. The plan to conduct the non-proliferation control was reviewed by the Nuclear Materials Section. The nuclear future in Finland was discussed in public during the whole year 2009, and a decision was prepared at the Ministry for Employment and the Economy in the beginning of 2010. The Government approved three Decisions-in-Principle on 6 May 2010, for TVO's Olkiluoto 4 unit, Posiva's spent fuel management project related to Olkiluoto 4, as well as Fennovoima's nuclear power plant. The Parliament ratified these decisions on 1 July 2010. The applicants for new power plants are requested to submit their nuclear construction license applications within 5 years. The applications concerning a third unit in Loviisa and Posiva's related project were rejected by the Government on 6 May 2010.

In its application the new nuclear stakeholder Fennovoima proposed two options for the location of its nuclear power plant. In the beginning of 2011, Fennovoima will choose the location and select the type of reactor to be built either at Pyhäjoki in North Ostrobothnia or at Simo in Lapland. Both of these are located at the sea coast of Bay of Bothnia. The choice will be based on assessments on safety, environmental concerns, technical implementation conditions and construction costs. The foundation works at the chosen site are scheduled to begin in 2012. It is estimated that the power plant will generate electricity by 2020. According to the Decision-in-Principle, the applicant Fennovoima was requested to make a plan for its nuclear waste management in 6 years time.

The authorisation of the three new nuclear facilities did not generate much work load at the Nuclear Materials Section during 2010. However, the practices obtained at the current construction sites in Olkiluoto clearly pointed out the need to bring in the safeguards requirements at an early stage of facility design. The early design information is generated, in principle, before the construction, but when planning the installation of containment and surveillance equipment and cabling, some of the desired precautions were missing both at the Olkiluoto 3 and the Onkalo facilities since they were not indicated in the official documents early enough. In order to improve and facilitate the future implementation of safeguards at new facilities STUK joined the Safeguards by Design Support Programme of the IAEA and initiated negotiations with all stakeholders to have the 3-S (safety, security, safeguards) concept included in the design requirements of new facilities.

2.4 New Front-End Facilities

A sulphide mine with uranium resources

The Talvivaara Mining Company announced on 9 February 2010 its interest in investigating the recovery of uranium as a separate product from its sulphide ore body. The Talvivaara deposits comprise one of the largest known sulphide nickel resources in Europe. The bioheapleaching technique developed for the deposits makes the extraction of metals from low grade ore economically viable. Therefore, in addition to nickel, zinc, copper, cobalt and uranium may be economically extracted and processed at the site. The company has submitted license applications according to the mining and nuclear energy legislation in order to recover uranium. The Basic Technical Characteristics (BTC) are already submitted to the European Commission, and the MBA code WTAL is assigned for the future uranium mine. The environmental impact assessment was carried out in 2010; and the production of uranium products is expected to start during 2011 if the licence application is granted.

This rapid progress has lead to several discussions and meetings concerning uranium exploration and mining in Finland. STUK and the Geological Survey of Finland have participated in several mining related activities during 2010. The stakeholders and interest groups were invited to a uranium seminar held in Helsinki 10 September 2010; and, the risks in uranium production and nuclear energy were discussed at another seminar in Kuopio 19–20 October 2010. STUK made strong contributions on these occasions. The uranium mining issues were widely discussed in the Finnish media during the whole year 2010.

Uranium in the nickel refinery

Norilsk Nickel operates the nickel refining plant at Harjavalta. The plant was commissioned in 1959, expanded in 1995 and again in 2002. Norilsk Nickel Finland became part of the Russian-based Norilsk Nickel as a result of the OM Group's nickel business acquisition in 2007. Norilsk Nickel Harjavalta refinery employs a technique of sulfuric acid leaching of nickel products. Norilsk Nickel aims to refine the Talvivaara nickel products. The uranium residuals will be extracted from the nickel products. STUK granted a license to extract less than 10 tons of uranium in a year, which is less than the limit to be subject to nuclear energy legislation and international reporting in March 2010. The responsible manager and his deputy were approved by STUK in September. The Norilsk Nickel company submitted the basic technical characteristics (BTC) to the European Commission in December 2010. The new MBA code for Norilsk Nickel Harjavalta is WNNH. Currently the uranium extracts are considered as waste, but the company is looking for customers for its planned uranium extracts and new products.

3 Safeguards activities in 2010

3.1 The regulatory control of nuclear materials

The application of integrated safeguards began in Finland on 15 October 2008. Thus, in the year 2009 the number of the IAEA inspections was reduced from approximately 25 person days to 15. Similarly, the European Commission reduced its inspection activities significantly. In 2010 the number of inspection days rose somewhat owing to first inspections at the geological repository site, additional inspection days at the Loviisa Nuclear Power Plant (NPP) and the increased number of random inspections in Finland. STUK continued with national safeguards measures as in the past. In 2010 the focus was on minor holders, which increased the number of inspection days of STUK. Nuclear material inventories at the end of 2010 are shown in Tables 2 and 3 in Appendix 1. The development of inspections and inspection person days per Material Balance Area (MBA) is presented in Figures 8 and 9. Inspections of STUK, the IAEA and the Commission in 2010 are presented in Appendix 2.

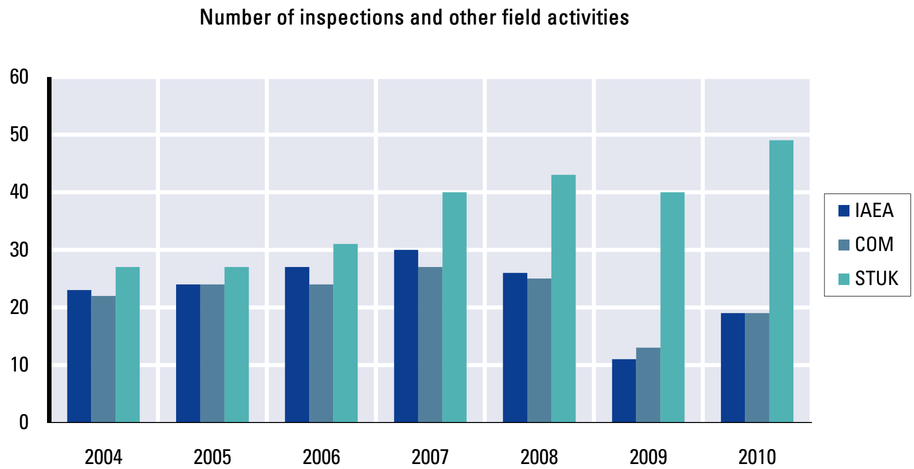

Figure 8. The number of inspections from 2004 to 2010.

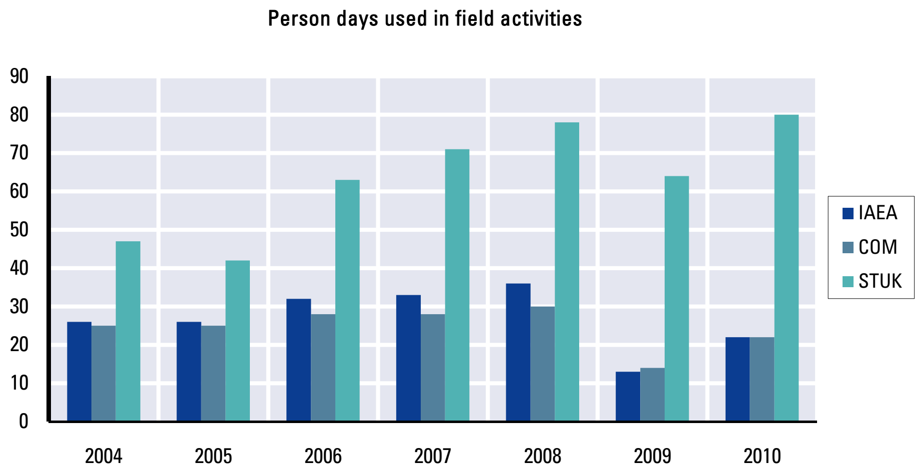

Figure 9. Inspection person days from 2004 to 2010.

3.1.1 Declarations and approvals of new international inspectors

All the relevant license holders sent their updated information for the national declaration, which is compiled by STUK, in time by 1 March 2010. STUK submitted Finland's annual declaration updates to the IAEA on 15 May 2010 as required. Additionally, STUK submitted the quarterly declarations on exports in February, May, August and November.

In 2010, altogether 16 IAEA and 8 Commission new inspectors were approved to perform inspections at nuclear facilities in Finland.

3.1.2 The Loviisa nuclear power plant site

In 2010 STUK granted the operating company Fortum one import license for nuclear dual use items, i.e. instrumentation.

In 2010 the IAEA and the Commission spent a few additional inspection days at the Loviisa NPP site. Because the crane in the spent fuel storage failed during the 2009 physical inventory verification (PIV) inspection on 6 October 2009, all of the fuel ponds could not be verified in 2009. The crane was repaired by 20 October 2009, but the re-inspection could not be scheduled earlier than 19–20 January 2010. During the first inspection of the year 2010 new surveillance cameras were installed at the spent fuel storage. This allows changes and simplifications in the integrated safeguards approach for the Loviisa NPP in the future.

New fresh fuel was imported and transported to the facility in spring 2010. During the fuel transfer campaign at the facility, the IAEA carried out an unannounced inspection (UI) on 20 May 2010 in order to verify the ongoing fuel transfer activities between the different key measurement points (KMP). STUK participated in this inspection carried out with only 2 hours notification. The IAEA expressed the need to update the design information owing to the installation of new fuel racks and thus increased storage capacity of the spent fuel storage.

The refuelling and maintenance outage of the Loviisa 1 reactor unit took place in the period 8 August – 2 September 2010, and that of the Loviisa 2 reactor unit in the period 4 September – 13 November 2010. Owing to the new integrated safeguards approach for Finland, the IAEA and the Commission performed a pre-inspection with STUK before the outage, on 4–5 August 2010. Temporary surveillance cameras were installed in the reactor halls for the outage period, and removed during the PIV carried out after the outage, on 19–20 October 2010. During the outage and before the closing of each reactor, STUK identified the fuel assemblies in the reactor cores and item counted the loading ponds. The Loviisa 1 core was inspected on 18 August 2010 and the Loviisa 2 core on 3 October 2010. During the outage, the cask transfer was inspected on 11 September 2010 by the IAEA and the Commission. In addition to the PIV and the core controls, STUK carried out two routine inspections and two measurement campaigns. The activities at the spent fuel storage facility were inspected twice.

At the Loviisa NPP STUK performed two non-destructive assay (NDA) verification measurement campaigns on spent fuel elements in 2010. The first campaign, 4–5 May, was carried out with FORK equipment, which delivers a gross gamma signal from an ionisation chamber and a neutron count rate from a fission chamber. STUK's FORK equipment is sometimes referred to as eFORK (enhanced FORK), because it incorporates a CdZnTe-gamma spectrometer. During the previous measurements with the FORK detector in 2009, the detector was flooded due to missing O-rings. The measurements and tests in May showed that the device had not suffered any major damage. The only part found not to be in operating condition was one of two gross gamma detectors, and it is possible that this detector might have been inoperative prior to the flooding. The measurement system is based on measuring relative signals compared to known assemblies, so one malfunctioning detector increases the statistical errors in the measurement, but does not impact the absolute value of results. 21 assemblies and 2 dummies were successfully verified during this campaign.

The second NDA campaign, 18–19 November 2010, was carried out with spent fuel attribute tester (SFAT) equipment with an HPGe gamma spectrometer. Traditionally, a SFAT device is equipped with a lower resolution NaI detector. This campaign had to be interrupted as the HPGe spectrometer ran out of liquid nitrogen due to leaking vacuum. Prior to this, 26 fuel elements were verified. The verification results were archived in the STUK NDA measurement database developed for the purpose. The measurements and the environmental samples collected at the Loviisa NPP did not indicate any inconsistencies in the reporting by the operator.

On the basis of its own assessment as well as of IAEA and Commission inspection results, STUK concluded that Fortum's Loviisa NPP has complied with its nuclear safeguards obligations in 2010.

3.1.3 The Olkiluoto nuclear power plant site

In 2010, STUK approved one new person to be appointed responsible for nuclear safeguards at the Olkiluoto NPP. During 2010 STUK also granted to the operating company TVO one export and fourteen import licences. These covered the export and import of end-of-life components to and from Sweden, and import of fresh nuclear fuel and nuclear dual use items, i.e. technology and instrumentation for the operating units and equipment to the new unit under construction.

Old superheaters, weighing in total about 700 tonnes were transported by m/s Sigyn to Sweden, to be treated in Studsvik, Sweden in 2010 and 2011. With Studsvik's treatment concept it is usually possible to free release and recycle 80–90 per cent of the metals in the end-of-life components, which reduces both storage costs and environmental impact. Residual products from the treatment will be sent back to Finland for final storage. The transport of the heat exchangers to Sweden was inspected by STUK on 4 May 2010.

The refuelling and maintenance outage of the Olkiluoto 2 reactor unit took place in the period 2–14 May 2010 and that of the Olkiluoto 1 reactor unit in the period 16 May – 12 June 2010. Similarly to the Loviisa NPP, the IAEA and the Commission performed a pre-inspection with STUK on 28 April 2010, before the outage, and the PIV after the outage, 16–17 June 2010. The outage at Olkiluoto 1 unit was the largest maintenance break in the facility's history. It took 26 days to replace and upgrade turbines, coolant systems etc. The power output was increased with 25 MW.

Figure 10. Inspection of the transport of superheaters to Sweden for treatment.

During the refuelling and maintenance outage STUK identified the fuel assemblies in the reactor cores and verified and item counted the loading ponds before the reactors were closed. The Olkiluoto 2 reactor was inspected on 8 May 2010 and the Olkiluoto 1 reactor on 6 June 2010. The outage and the core verification at Olkiluoto 2 were delayed for a day and a half owing to a failure in the fuel handling machine. The outage at Olkiluoto 1 was well on time but there was a human identification error in the transfer of fresh fuel elements from the storage to the reactor hall pool. The error was recognised before the loading of the reactor itself, but some delay took place owing to the fact that correct individual fuel assemblies had to be transferred from the fresh fuel storage.

The IAEA random interim inspections to Finland were addressed to the Olkiluoto NPP: on 24 February to the Olkiluoto 1 unit, on 18 August to the spent fuel storage, and on 28 October again to the spent fuel storage. STUK carried out two additional routine inspections for the Olkiluoto site and the material balance areas (MBA) at the Olkiluoto NPP.

At the Olkiluoto NPP STUK performed two non-destructive assay (NDA) verification measurement campaigns on spent fuel elements in 2010: 14–16 June and 29 November to 1 December. During both of the campaigns STUK performed Gamma Burnup Verification (GBUV) measurements at the Olkiluoto spent fuel storage. Altogether 65 spent fuel assemblies were verified. The results were archived in the mobile version of the NDA measurement database.

The measurement campaigns were concentrated on the spent fuel storage since it is expected that the construction of the spent fuel storage enlargement will limit the measurement access to spent fuel in the storage in coming years. Thus, to offset this, these assemblies are the target of most measurement campaigns at Olkiluoto prior to this.

The construction of the new Olkiluoto 3 reactor (OL-3) has proceeded to such a stage that nuclear items are to be imported to the site. The turbine hall with its instrumentation proceeds well, but the reactor building is delayed. However, the main components are under manufactory, assembly and STUK's regulatory control. TVO prepared a draft for the basic technical characteristics (BTC) of the new unit in 2008. This first BTC was reviewed by STUK, the IAEA, and the Commission twice in 2008. Thus, the inspectorates have the possibility to plan the surveillance and containment measures in advance. Future actions were, during 2009, waiting for the advancement of the construction of the fuel handling buildings. The IAEA and the Commission visited the OL-3 construction site on 3 March 2010 to adjust containment and surveillance instrumentation on site. The locations of cameras and control units were agreed to for the reactor building. The fuel handling systems were still heavily under construction and thus the locations of cameras and control units could not yet be determined for the fuel handling building. The final BTC is due at least 200 days before the first consignment of nuclear material is to be received. The commissioning of the OL-3 unit is postponed until 2013.

The spent fuel storage building at the Olkiluoto NPP will be enlarged to have capacity for the spent fuel of the future. New ponds will be constructed for fuel assemblies from the operating reactors and from that under construction. The IAEA and the Commission inspectors reviewed the plans and visited the spent fuel storage on 2 March 2010, in order to plan containment and surveillance measures during and after the enlargement of the storage building. No new access routes will be made to the building. During the enlargement and also during future operation, the existing surveillance is expected to cover accurately the whole enlargement area of the storage.

On the basis of its own assessment as well as IAEA and Commission inspection results, STUK concluded that TVO's Olkiluoto NPP has complied with its nuclear safeguards obligations in 2010.

3.1.4 The VTT FiR1 research reactor site

In 2010 STUK carried out two interim inspections to the VTT research rector site. The site declaration and activities and internal control systems were reviewed on 9 March. Safeguards inspectors from STUK and the European Commission verified the nuclear material inventory of VTT on 2 June 2010. There were some inconsistencies in reporting but the nuclear material inventory was concluded to be correct. As follow-up actions STUK remarked that the operator shall update the nuclear materials handbook to cover the bookkeeping and reporting of nuclear items and equipment. The reporting of unreported graphite pins to STUK and update of the basic technical characteristics (BTC) to STUK and the Commission were requested. The follow-up interim inspection was carried out on 12 October 2010 to clarify remarks made during previous inspections.

On the basis of its own assessment as well as IAEA and Commission inspection results, STUK concluded that the VTT FiR1 operator has complied with its nuclear safeguards obligations in 2010.

3.1.5 The STUK site

Safeguards inspectors from STUK and the European Commission and the IAEA verified the nuclear material inventory of STUK on 1 June 2010. Additionally, the IAEA carried out complementary access to the STUK site in order to clarify the site boundaries and some activities at the research department. There where some changes in companies located in the non-STUK premises of the STUK building. A surveying company had left the building a few years ago and the new Nuclide Analytics Company (Suomen Nuklidianalytiikka) is present near STUK laboratories. This company is founded and operated by a former STUK staff member.

Organisational questions at the operator were remarked. Owing to outsourcing of staff and activities at the national waste receiving station of STUK, the responsibilities and boundaries at the operator were not clearly indicated. STUK has nuclear material at a few locations outside of the site, not only at the Central Storage at Olkiluoto NPP as declared. These additional locations should be reported as clearly defined KMPs. Thus, the need to update the BTC was indicated.

The physical inventory verification was completed at the storage located in Olkiluoto on 15 June 2010 in conjunction to the PIV inspection to the Olkiluoto NPP. The operator was presented by the nuclear materials inspector. The STUK Nuclear Materials Section has approved the person responsible for the nuclear material accountancy and control at STUK, but the requirement to have a deputy approved is not fulfilled at STUK owing to outsourcing. This internal organisational question is to be solved.

3.1.6 The University of Helsinki site

Safeguards inspectors from STUK and the European Commission verified the nuclear material inventory of the University of Helsinki on 3 June 2010. There were some rounding and timing inconsistencies in reporting but the nuclear material inventory at the Laboratory of Radiochemistry was concluded to be correct. STUK remarked that the operator shall update the reporting of nuclear materials and the basic technical characteristics (BTC). This was done by the operator in June as requested.

On the basis of its assessment and inspection results, STUK concluded that the University of Helsinki has complied with its nuclear safeguards obligations in 2010.

3.17 Minor nuclear material holders

In 2010 several STUK inspections were focused on the minor holders in order to assure that the capabilities and procedures are adequate. STUK inspected the reports from the minor nuclear material holders. The international inspectorates did not make other types of inspections to the minor holders.

On the basis of its assessment and inspection results, STUK concluded that the minor nuclear material holders have complied with their nuclear safeguards obligations in 2010.

3.1.8 New stakeholders

In 2010 STUK granted an operation license to Norilsk Nickel Harjavalta for producing, storing and handling uranium as a by-product of the nickel purification process for an annual amount of less than 10 metric tons. STUK also approved one person and a deputy to be appointed responsible for nuclear safeguards at the facility.

3.1.9 The final disposal facility site for spent nuclear fuel

In 2010 the geological repository site was declared within article 2a(iii) of the Additional Protocol. Previously, the Onkalo project for the final disposal of spent nuclear fuel had been declared within article 2a(x) of the Additional Protocol to the Safeguards Agreement since the entry-in-force of the Protocol in 2004. The Commission assigned the Material Balance Area (MBA) code W0LF to Onkalo in January 2008. Following the development of the Design Information Questionnaire (DIQ) at the IAEA in 2008 for the encapsulation plant and the geological repository, the Commission prepared the Annex H-I of the safeguards regulation – adopted for the geological repository – for the basic technical characteristics (BTC) in 2009. Consequently, in 2009 STUK forwarded the BTC prepared by Posiva to the Commission. In 2010 Posiva provided an update of the BTC document. Additionally, the Posiva site was declared, for the first time, under article 2a(iii) in Finland's annual declaration in 2010, in order to facilitate the IAEA integrated safeguards approaches.

Posiva updated its non-proliferation handbook in March 2010 to clarify and update the descriptions of some of Posiva's safeguards practices. However, this update did not consider the need to prepare the early Design Information and the Site Declaration as indicated by the IAEA and the Commission. Therefore, the update was not accepted by STUK, and a renewed version was requested.

During the year 2010 STUK carried out three interim inspections to the underground premises of the final disposal facility. The IAEA joined one of these by means of Complementary Access. A Euratom inspector was also present during the inspection at the Olkiluoto site. The IAEA inspected the underground premises, the shaft and the ventilation technology building where there will be access routes to the underground premises.

Several meetings were arranged between the Finnish and Swedish authorities and operators, the Commission and the IAEA during the year 2009 in order to clarify and facilitate safeguards measures for the final disposal of spent nuclear fuel. This Six-Party communication was continued in a meeting arranged at Olkiluoto on 23–24 November 2010. This meeting was focused on the verification issues prior to spent fuel encapsulation.

3.1.10 Nuclear dual use items, export licenses

In 2010 the Ministry for Foreign Affairs issued four licences for exporting nuclear process modelling software to the Russian Federation, People's Republic of China, Slovenia and Slovakia. STUK issued the license to export and import end-of-life components to Sweden.

3.1.11 Transport of nuclear materials

In 2010, fresh nuclear fuel was imported to Finland from Spain, Sweden and the Russian Federation (Table 1). In relation to these imports, STUK approved three transport plans and inspected one transport of fresh nuclear fuel. Furthermore, STUK approved one package design for a package to be used in transports of fissile material.

3.1.12 International transfers of nuclear material

In 2010, TVO reported to STUK about its international fuel contracts, fuel transfers and fuel shipments. STUK carried out an on-site inspection where TVO's nuclear material accountancy on the fresh fuel imported in 2010 was verified against the original shipment documents covering the international transfers. The accountancy of the natural uranium in TVO's possession but stored outside of the Olkiluoto NPP site was also inspected. Based on the findings, STUK concluded that TVO has complied with its safeguards obligations in purchasing the nuclear fuel and managing its international transfers.

3.1.13 Incidents in 2010

A high-enriched uranium contaminated metal item was detected in Finland in the spring of 2010, within a scrap metal shipment from abroad. The origin and composition of the contaminated metal item was under investigations during the year. The Joint Research Centre, Institute of Transuranium Elements (JRC-ITU) in Karlsruhe assisted in the investigations. It was concluded that the item has to be taken into the possession of the state.

The export control of dual-use equipment is a growing global challenge. The expansion of nuclear energy to new states gives possibilities to expand international trade. This was demonstrated in the summer of 2010 as the international press discussed the effects of the Stuxnet worm at the Iranian nuclear power plant. The virus affected the control systems for components manufactured by a Finnish company. The export licensing that had taken place in the past was reviewed by the Finnish authorities.

3.2 International developments in safeguards

In the international nuclear safeguards development fora, the major topics during the year 2010 were the successes in the NTP review conference and that in the IAEA safeguards symposium. The advances in disarmament and efficiency in safeguarding new facilities were addressed. The roles, responsibilities and practices of the three levels of safeguards in place within the EU – those of the IAEA, those of the European Commission and those of the EU Member States – were discussed in a constructive atmosphere, with the objective of enhancing cooperation and improving cost efficiency. The event was described as one of the themes of the year. STUK contribution can be found in Chapter 2 and in several references in Chapter 6.

STUK contributed to the work of IAEA's Standing Advisory Group on Safeguards Implementation (SAGSI) in 2010 by having a member in SAGSI. Safeguards implementation issues considered by SAGSI during the year included Integrated Safeguards issues, furthering the state level safeguards concept, cooperation with State Systems of Accounting for and Control of Nuclear Materials (SSAC), strategic planning, future Safeguards Implementation Report, and a safeguards R&D plan.

The European Nuclear Society (ENS) organised a conference in June in Barcelona. Safeguards-related topics were included in the programme. At the conference STUK gave the presentation "A selection of recent achievements and future challenges in safeguards R&D as identified by the ESARDA" on behalf of the European Safeguards Research and Development Association's (ESARDA).

In 2010 STUK continued its participation in the ESARDA working groups and the steering committee meeting. During 2010 STUK's representative continued her two-year term as the President of

ESARDA. Thus, STUK had strong influence in the ESARDA Executive Board and via ESARDA also at the INMM and IAEA conferences. The head of STUK's Security Technology Laboratory started his term as chairperson of the ESARDA Novel Technologies/Novel Approaches (NA/NA) Working Group.

In 2010, the group of experts for Application of Safeguards to Geological Repositories (ASTOR) met at the Joint Research Centre in Ispra in November. Novel technologies to be applied for safeguards purposes at this new type of facility were presented and discussed during the meeting. In addition to the repository safeguards, verification of spent nuclear fuel prior to disposal was addressed. One multilateral meeting between the IAEA, the European Commission, Finland, and Sweden on the implementation of safeguards for geological repositories was held in Olkiluoto 23–24 November. Several observers participated in this Six-Party meeting.

The Nordic symposium on non-proliferation issues was arranged by STUK at Naantali SPA 21–22 April 2010. The topics covered the main developments in the field of safeguards: current strategies and policies at the IAEA and the Commission, experiences from the implementation of integrated safeguards in the Nordic countries, the integration of nuclear security and safeguards, nuclear disarmament and expectations for the coming NPT review conference. Unfortunately, air traffic was blocked during those days by the ash cloud originating from the Eyjafjallajökull volcano on Iceland. This reduced the number of participants from the traditional 50 to only 20. Those who could make the trip via road, rail or sea enjoyed the co-operative atmosphere with several remote presentations.

3.3 Bilateral cooperation and peer-to-peer exchanges strengthen regional security

Finland's bilateral cooperation programmes in the area of non-proliferation are directed mainly towards our neighbouring countries outside the EU and are motivated by the continued need for enhancement of the regional security environment. Accordingly, STUK continued its cooperation programme with the Russian Federation. The focus in 2010 was on the cooperation with the Russian nuclear security and safeguards authorities, mainly through peer-to-peer exchanges. Collaboration with Ukraine in mutually beneficial areas was reestablished in 2008 and an agreement about a programme was made between the State Nuclear Regulatory Committee of Ukraine (SNRCU) and STUK. The focus in 2009–2010 was on the construction of the Mobile Measurement Laboratory to be used by SNRCU.

3.3.1 Cooperation with the Rostechnadzor, Russia

Cooperation between Finnish and Russian authorities, technical support organisations and industrial partners included two workshops in the area of regulatory supervision of accountancy, control and protection of nuclear and other radioactive materials. Representatives of Rostechnadzor and Moscow RADON visited STUK and the Olkiluoto nuclear power plant (NPP) site to get acquainted with the TVO and Posiva projects and particularly with the handling and control of nuclear and radioactive waste.

The demonstration of the spent fuel attribute tester (SFAT) measurement device for the Rostechnadzor was successfully carried out in November 2008 at the Kola nuclear power plant. The device was returned, as planned, to the Security Technology Laboratory at STUK and was tested and prepared for shipment to the Ozersk Office of the Rostechnadzor in 2009. During 2010 a new computer was obtained for the system and software installed accordingly. Steps were taken to organize the shipment in 2011. This bilateral work complements the work done within the EU-financed TACIS project aiming at improving the control of the handling of nuclear material at Mayak reprocessing plant. The first part of this EU project was completed in 2010; the second will be completed in 2011.

Finnish and Russian Customs Authorities met in St. Petersburg and in Helsinki in June and December 2010. As a result, it was decided to continue with the joint customs training activities during 2011. The possibility to organize specific exercises aimed at CBRN protection of the fast train Allegro that started its operation between Helsinki and St. Petersburg in December 2010 was also discussed.

3.3.2 The programme with Ukraine: delivery of the mobile laboratory

During 2009 the focus was on manufacturing and delivering a Mobile Laboratory vehicle for the use of the State Nuclear Regulatory Committee of Ukraine (SNRCU). Subsequently, by the end of that year, the experts from the IAEA, Ukraine, Sweden, and the European Commission were getting acquainted with its technical, functional and operative features at STUK. The mobile measuring laboratory: Sophisticated ON-site Nuclide Identification (SONNI) enables identifying and analysing radioactive sources and nuclear materials in the environment, at industrial facilities and in cases of threatening situations. The laboratory includes measuring, sampling, positioning and communication systems. Data can be transmitted in real time to the control centre, where the data may be entered into a map system, thus providing real-time information for the management of the operations. At locations where the vehicle cannot have access, a portable (rucksack) application with the same functionality can be used. This additional capacity and functionality will significantly extend the usefulness of this monitoring vehicle.

The top-modern radiation measuring vehicle with the portable application unit was donated to the IAEA. The vehicle started its journey from STUK on Monday, 12 April 2010 and arrived via the IAEA to the SNRCU in Kiev on 14 December 2010. Both units are based on proven technology, demonstrated by STUK through their years long routine use.

Figure 11. The mobile measuring laboratory finally in Kiev with Mr. Moore of the IAEA and Mr. Rautjärvi of STUK.

STUK also participated in the tasks of the cooperation programme between the Swedish Radiation Safety Authority (SSM) and the Ukraine authorities including the SNRCU. Experts from STUK participated in the review and development of the national system of nuclear material accountancy and control and in the non-proliferation regime including the nuclear fuel cycle related activities in Ukraine.

3.4 The Finnish National Data Centre for the Comprehensive Nuclear-Test-Ban Treaty

3.4.1 International cooperation is the foundation of CTBT verification

During 2010 the Finnish National Data Centre (FiNDC) participated in meetings of the Working Group B (WGB) of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). WGB is a policy making organ for the technical development of the verification regime. By participating in the work of WGB and its subsidiaries (workshops and expert groups), the FiNDC can provide technical expertise to the CTBTO, while also attending to the Finnish national interests.

3.4.2 The analysis pipeline is a well established daily routine

The FiNDC continued developing its own routine monitoring system for the data received from the International Monitoring System's network (IMS). The FiNDC routinely analyses all radionuclide measurement data generated at the IMS radionuclide stations across the world. The IMS network is still developing, and the number of operational air filter stations was about 60 at the end of 2010 (at the final stage there will be 80). The operational stations generated approximately 700 gamma spectra per day for the FiNDC analysis pipeline to handle. The analysis pipeline is linked to the LINSSI database and equipped with an automated alarm system, to enable efficient and fully automated screening of the data.

The number of IMS stations equipped with xenon measurement capabilities was 26 at the end of 2010. The first IMS xenon system gained CTBT certification in 2010 (RNX75, Charlottesville, USA). During the year FiNDC developed its capabilities to receive and analyse NG data and now all NG data is analysed at the FiNDC and stored in the databases alongside with analysis results provided by the International Data Centre (IDC). Xenon measurements are especially important for CTBT verification, because xenon, as a noble gas, often leaks also from underground tests, which seldom release particulate matter.

3.4.3 An interesting alarm

In May 2010 FiNDC detected a signal of radionuclide particles with very high CTBT relevance in spectra from two stations situated close to each other. As FiNDC analyses also preliminary spectra that are sent from the stations during measurements, it was among the first ones to pick up the signal, almost a whole day before even preliminary results from the International Data Centre where available. FiNDC delivered status reports to its collaborators and cooperated internationally to resolve the situation. Despite extensive international co-operation, the source of the release is still unknown, but further analysis of the data has shown that it is not consistent with any probable release scenario from a nuclear test. As the seismic network did not detect any indications of testing in the area at that time, it is safe to conclude that this was a false alarm.

4 Human resources development

Nuclear safeguards by the Nuclear Materials Section of STUK cover all typical measures of a State System of Accounting for and Control of Nuclear Materials (SSAC), and many other activities besides. The nuclear fuel cycle related activities, e.g. research and development activities not involving nuclear material and manufacture of certain equipment as defined it the Additional Protocol (AP) have enlarged the scope of traditional safeguards. Nuclear safeguards on the national level are closely linked with other functions of nuclear materials control and non-proliferation: licensing, export control, border control, transport control, combating illicit trafficking, the physical protection of nuclear materials, and monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Continuous analysis of the developments in the involved fields of both technology and politics is a daily, multidisciplinary task at the STUK Nuclear Materials Section.

The personnel's competence is systematically developed taking into account the needs of the organisation and the wishes of the individuals (see Figure 12). Those aiming at an expert's career are valued as highly as those interested in managerial duties. At the Nuclear Materials Section, the management participated in the general course for managers at government organisations provided by the Finnish Institute of Public Management. The internal training programme of the section continued, and experts participated in a few international courses. During 2010 the main focus was in nuclear forensics and security related training courses. One of the staff members participated in the 1-week ESARDA safeguards course at the Joint Research Centre at Ispra, Italy and in the 5-week national course for nuclear safety.

Competences were improved considerably in 2010. Anna Lahkola defended her PhD thesis on 4 June 2010 at Tampere University. Antero Kuusi graduated from Aalto University School of Technology and was appointed as inspector. The RADAR project to educate and train Finnish Customs officers benefited from the co-operation established with the Joint Research Centre. During 2010 the supervisors of the Finnish Customs were educated at JRC Ispra. Moreover, Suvi Lehtinen was employed as trainee during the summer to assist the instrumentation at the border control stations.

The internal training programme of safeguards inspectors at STUK continued in 2010. There were two seminar lectures arranged at STUK. The first concerned the international transfers of nuclear material and the second was about STUK's licensing procedure regarding nuclear material. Moreover, one seminar also concentrated on current issues of nuclear non-proliferation and was held in cooperation with the Ministry for Foreign Affairs and the Ministry of Employment and the Economy.

The Nuclear Materials Section has emergency preparedness responsibilities as part of the common preparedness system of STUK. The Nuclear Materials Section is the main responsible section inside STUK in response to those safety and security related incidents that involve nuclear materials and are not in purview of the Nuclear Reactor Regulation, which has responsibility for all incidents in nuclear power plants and the research reactor. New internal guidance for handling these incidents was finalised in 2010, which will help the response to any future incidents.

In addition to being the responsible section for the above cases, the personnel of the Nuclear Materials Section assist other sections in response to any incidents that may include nuclear materials or require their expertise for any other reason.

Some of the Nuclear Materials Section staff are also part of the pool of Experts-on-Duty, who receive the notifications for incidents and are responsible for initiating the STUK response. The urgent fax and telephone system of the preparedness system is also used to transfer the information about a short notice IAEA inspection rapidly to the Nuclear Materials Section.

In April STUK replaced the traditional office telephones by mobile phones. However, the traditional telephone numbers remained during office hours, if so desired by the employee. A few wired telephone and fax lines remained for parallel use. This improves the availability of the staff, but the arrangement may initially confuse the license holders, partners, customers and other stakeholders.

The staff of STUK Nuclear Materials Section. All section staff participate in the core safeguards tasks. Additionally, each person has some special areas of expertise to focus on.

Mr. Timo Ansaranta	Inspector	Control of competence at facilities and at small holders
Ms. Ritva Kylmälä	Assistant	
Mr. Marko Hämäläinen	Senior Inspector	Inspection coordination, handbooks, Additional Protocol implementation
Ms. Anna Lahkola	Senior Inspector	Transport of nuclear materials, central accountancy
Mr. Tapani Honkamaa	Senior Inspector	Non-destructive assay, FINSP to the IAEA safeguards
Mr. Antero Kuusi	Inspector	Databases, non-destructive assay
Ms. Elina Martikka	Section Head	Management
Mr. Olli Okko	Senior Inspector	Safeguards of research and development, final disposal
Mr. Mikael Moring	Senior Inspector	Finnish National Data Centre for the CTBT, non-destructive assay, environmental sampling
Mr. Tero Varjoranta	Director	Resourcing until July 2010
Mr. Risto Paltemaa	Director	Resourcing, Management
Ms. Arja Tanninen	Deputy Director	Licensing, permits

Figure 12. The staff of Nuclear Materials Section.

5 Conclusions

The implementation of the International Atomic Energy Agency (IAEA) integrated safeguards began in Finland on 15 October 2008. Thus, the year 2009 was the first whole year with the new approach. The number of IAEA inspection days was reduced from the approximately 25 person days per year of the past to 13. Similarly, the European Commission reduced its inspection activities to 14. STUK continued with national safeguards measures and activities with 64 inspection days and 40 inspections. In order to be present at the short notice IAEA inspections, agreed to compensate for the reduced number of routine inspections, STUK raised preparedness to have a daily on-the-alert inspector. In 2010 the number of the inspection days of the international organisations was somewhat higher than in 2009, because a few issues remained from the previous year and because of the raised number on random interim inspections in 2010.

In 2010 STUK performed 27 safeguards inspections at the Finnish nuclear power plants (NPP), ten at the Loviisa NPP and 17 at the Olkiluoto NPP. The Commission and the IAEA took part in 19 of these inspections. STUK performed four non-destructive assay measurement campaigns, two at the Loviisa NPP and two at the Olkiluoto NPP. At other facilities, STUK performed four safeguards inspections, of which the Commission took part in the physical inventory verification at the VTT research reactor. At the geological repository of spent nuclear fuel, the IAEA and the Euratom carried out first inspections. The IAEA carried out complementary access to the STUK site and to the geological repository site to verify declared activities and the absence of undeclared activities. The IAEA sent its safeguards statements to the Commission, which amended them with its own conclusions and forwarded them to STUK. The conclusions by the Commission were in line with the IAEA's remarks as well as STUK's findings; there were no outstanding questions by the IAEA or the Commission at the end of 2010.

The results of STUK's nuclear safeguards inspection activities continued to demonstrate that the Finnish licence holders take good care of their nuclear materials. There were no indications of undeclared materials or activities and the inspected materials and activities were in accordance with the licence holders' declarations. Two license holders' organisational safeguards procedures were remarked at. After the outsourcing at STUK the responsibilities at the operator were not in compliance with the national requirements. Neither the IAEA nor the Commission made any remarks nor did they present any required actions based on their inspections. By their nuclear materials accountancy and control systems, all license holders enabled STUK to fulfil its own obligations under the international agreements relevant to nuclear safeguards and non-proliferation.

The purpose of the Finnish chemical, biological, radiological, and nuclear (CBRN) Task Force is to advance measures to deter, prevent, detect and respond to illicit CBRN activities, and to enhance coordination and cooperation between national authorities involved in the counter-CBRN effort. In 2010 STUK Nuclear Materials Section cooperated closely with the Finnish Customs to offer expert advice in development of radiation monitoring at borders, including training for Customs officers.

A major goal of all current Comprehensive Nuclear-Test-Ban Treaty (CTBT) related activities is the entry into force of the CTBT itself. To reach this goal, major steps have to be taken in the political arena, and an important prerequisite for positive political action is that the verification system of the CTBTO is functioning and able to provide assurance to all parties that it is impossible to make a clandestine nuclear test without getting detected. The FiNDC is committed to its own role in the common endeavour so that the verification system of the CTBTO can accomplish its detection task. While still incomplete, the verification system has already demonstrated its potential for detecting nuclear tests.

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7 Abbreviations and acronyms

ADR
European Agreement concerning the International Carriage of Dangerous Goods by Road

AP
Additional Protocol to the Safeguards Agreement

AQG
Atomic Questions Group of the Council of the European Union

ASTOR
Application of Safeguards to Geological Repositories

BTC
Basic Technical Characteristics

CA
Complementary Access

CBRN
Chemical, biological, radiological and nuclear (such as in “protective measures taken against CBRN weapons or hazards”)

CdZnTe
Cadmium zinc telluride

CTBT
Comprehensive Nuclear-Test-Ban Treaty

CTBTO
Comprehensive Nuclear-Test-Ban Treaty Organization

DIQ
Design Information Questionnaire

DIV
Design Information Verification

DU
Depleted uranium

eFORK
enhanced FORK with a CdZnTe-gamma spectrometer (see FORK)

ES
Environmental Sampling

ESARDA
European Safeguards Research and Development Association

EU
European Union

FA
(1) Facility Attachment according to the Safeguards Agreement (INFCIRC/193), (2) Fuel Assembly

FiNDC
Finnish National Data Centre for the CTBT

FINSP
Finnish Support Programme to the IAEA Safeguards

FORK
Spent fuel verifier with gross gamma and neutron detection

GBUV
Gamma Burnup Verifier

GICNT
Global Initiative for Combating Nuclear Terrorism

HEU
High-enriched uranium

HPGe
High-Purity Germanium

IAEA
International Atomic Energy Agency

IMS
International Monitoring System (of the CTBTO)

ITU
Institute of Transuranium Elements in Karlsruhe

INFCIRC
Information Circular (IAEA document type, eg. INFCIRC/193, Safeguards Agreement, or INFCIRC/140, the Non-Proliferation Treaty)

IPPAS
International Physical Protection Advisory Service

IS
Integrated Safeguards

ISSAS
International SSAC Advisory Service

ITWG
International Technical Working Group for combating illicit trafficking of nuclear and other radioactive materials

JRC
The Joint Research Centre

KMP
Key Measurement Point

LEU
Low-enriched uranium

LINSSI
an SQL database for gamma-ray spectrometry

MBA
Material Balance Area

MEE
Ministry of Employment and the Economy

MFA
Ministry for Foreign Affairs

NDA
Non-Destructive Assay

NM
Nuclear Material

NPP
Nuclear Power Plant

NPT
The Treaty on the Non-proliferation of Nuclear Weapons (INFCIRC/140, “Non-Proliferation Treaty”)

NSG
Nuclear Suppliers’ Group

Onkalo
Underground rock characterisation facility (for the final disposal of spent nuclear fuel)

PIV
Physical Inventory Verification

PSP
Particular Safeguards Provisions

PTS
Provisional Technical Secretariat (to the Preparatory Commission of the CTBT)

Pu
Plutonium

RL07
Radionuclide Laboratory to the CTBT hosted by STUK (FIL07)

SA
Subsidiary Arrangements

SAGSI
Standing Advisory Group on Safeguards Implementation

SFAT
Spent Fuel Attribute Tester

SNRCU
State Nuclear Regulatory Commission of Ukraine

SNRI
Short Notice Random Inspection

SNUICA
Short notice, unannounced inspection, complementary access on-alert inspector

SSAC
State System of Accounting for and Control of Nuclear Materials

SSM
Swedish Radiation Safety Authority

Th
Thorium

U
Uranium

UI
Unannounced Inspection

UNSC
United Nations Security Council

VTT
Technical Research Centre of Finland

WGB
Working Group B (of the CTBTO)

APPENDIX 1 Nuclear materials in Finland in 2010

Table 1. Summary of nuclear material receipts and shipments in 2010.

To	From	FA	LEU (kg)	Pu (kg)
WOL1	Spain	100	17 695	–
WOL2 (1/2)	Sweden	58	10 027	–
WOL2 (2/2)	Sweden	60	10 359	–
WOLS	WOL1	40	6 612	58
WOLS	WOL1	40	6 611	58
WOLS	WOL1	40	6 606	58
WOLS	WOL1	40	6 608	58
WOLS	WOL2	41	6 881	61
WOLS	WOL2	41	6 868	61
WOLS	WOL2	41	6 855	61
WOLS	WOL2	41	6 865	61
WOLS	WOL2	41	6 848	61
WOLS	WOL2	41	6 850	61
WLOV (1/2)	Russian Federation	90	11 363	–
WLOV (1/2)	Russian Federation	90	11 357	–

WOL1, WOL2 & WOLS = Olkiluoto NPP, WLOV = Loviisa NPP, FA = fuel assembly; LEU = low-enriched uranium, Pu = plutonium.
Note: WOL1 and WOL2 shipments are marked only once into the table as WOLS receipts.

Table 2. Fuel assemblies at 31 December 2010.

MBA	FA/SFA *)	LEU (kg)	Pu (kg)
WOL1	1 022/444	175 556	676
WOL2	1 005/433	167 702	625
WOLS	6 556/6 556	1 110 318	9 306
WLOV	4 851/4 171	561 874	5 075

MBA = material balance area, FA = fuel assembly, SFA = spent fuel assembly

*) FAs in core are accounted as fresh fuel assemblies
(Loviisa NPP 313 FAs and Olkiluoto NPP 500 FAs per reactor)

Table 3. Total amounts of nuclear material at 31 December 2010.

MBA	Natural U (kg)	Enriched U* (kg)	Depleted U (kg)	Plutonium (kg)	Thorium (kg)
WOL1	–	175 771	–	677	–
WOL2	–	167 742	–	626	–
WOLS	–	1 110 318	–	9 306	–
WLOV	–	561 875	–	5 075	–
WRRF	1 511	60.087	0.002	< 0.001	–
WFRS **WFRS ***	0.170 (44.508)	0.536 (0.888)	12.952 (1 010)	– (0.003)	– (2.5)
WKKO	2 599	–	–	–	–
WHEL	41.225	0.290	20.010	0.003	2.994
Minor holders	0.2	0.00116	1146.3	~ 0	0.163

MBA = material balance area, WRRF = VTT FiR-1/VTT Processes, WFRS = STUK, WKKO = OMG Kokkola Chemicals, WHEL = Laboratory of Radiochemistry at the University of Helsinki, U = uranium. *) Less than 150 g of high-enriched uranium, mainly used in detectors.

APPENDIX 2 Safeguards field activities in 2010

General information			Inspections			Inspection person days		
MBA	**Date**	**Inspection type**	**IAEA**	**COM**	**STUK**	**IAEA**	**COM**	**STUK**
WLOV	19–20 January	PIV completion	1	1	1	2	2	2
WOL1	24 February	SNRI	1	1	1	1	1	1
WOLF	2 March	As built DIV	1	1	1	1	1	1
WOL2, WOLS								
Olkiluoto site	2 March	Interim Inspection	0	0	2	0	0	1
WRRF	9 March	Nuclear Materials and site	0	0	1	0	0	2
WLOV	11 March	Interim Inspection + site verification	0	0	1	0	0	1
Dekra	16 March	PIV	0	0	1	0	0	1
GTK	17 March	PIV	0	0	1	0	0	1
Oxford Instruments	17 March	PIV	0	0	1	0	0	1
Finnair	18 March	PIV	0	0	1	0	0	1
HYRL	31March	PIV + site verification	0	0	1	0	0	1
WOL1, WOL2	28 April	pre-PIT	2	2	2	2	2	2
WLOV	28 April	Inspection of SFA	1	1	1	1	1	1
WOL2	8 May	Core Verification	0	0	1	0	0	1
WLOV	20 May	UI	1	0	1	1	0	1
WFRS	1 June	PIV	1	1	1	1	1	2
SSFSTUK (WFRS)	1 June	Complementary Access (2 h)	1	1	1	1	1	2
WRRF	2 June	PIV	0	1	1	0	1	1
WHEL	3 June	PIV	0	1	1	0	1	1
WOL1	6 June	Core Verification	0	0	1	0	0	1
SSFPOSI	15 June	Complementary Access	1	0	1	1	0	1
WOLF	15 June	As built DIV	0	0	1	0	0	1
WFRS Olkiluoto	15 June	PIV, KMP B in Olkiluoto	1	1	1	1	1	2
WOL1,WOL2, WOLS	16–17 June	PIV	3	3	3	3	3	3
WLOV	6 July	Interim Inspection	0	0	1	0	0	1
WLOV	4–5 August	Pre-PIT	1	1	1	2	2	2
WLOV	17 August	Lo1 Core Verification	0	0	1	0	0	1
WOLS	18 August	SNRI	1	1	1	1	1	1
WLOV	11 September	Cask transfer from Lo2	1	1	1	1	1	1
TVO Helsinki Office	24 September	International Transfers NMAC Inspection	0	0	1	0	0	1
WLOV	3 October	Lo2 Core Verification	0	0	1	0	0	1
WOLF	7 October	As built DIV	0	0	1	0	0	2
WRRF	12 October	Interim inspection	0	0	1	0	0	1
WOL1, WOL2, WOLS	21 October	Interim + System Inspection	0	0	4	0	0	8
WLOV	19–20 October	PIV	1	1	1	2	2	2
WOLS	28 October	SNRI	1	1	1	1	1	1
WOLF	11 November	System Inspection	0	0	1	0	0	2
WOL2	23 November	Inspection of SFA	0	0	1	0	0	1
WLOV	4–5 May	eFORK	0	0	1	0	0	4
WLOV	18–19 November	SFAT	0	0	1	0	0	4
Olkiluoto	14–16 June	GBUV	0	0	1	0	0	6
WOLS	29 November – 1 December	GBUV	0	0	1	0	0	6
TOTAL			**19**	**19**	**49**	**22**	**22**	**77**

Note: At the Olkiluoto NPP, inspections are counted per MBA. MBA = material balance area, PIV = Physical Inventory Verification, CA = Complementary Access, ES = Environmental Sampling, NM = nuclear material, SFAT/eFORK/GBUV = methods of non-destructive assay.

APPENDIX 3 International agreements and national legislation relevant to nuclear safeguards in Finland

Valid legislation, treaties and agreements concerning safeguards of nuclear materials and other nuclear items at the end of 2010 in Finland (Finnish Treaty Series, FTS):

1. The Nuclear Energy Act, 11 December, 1987/990 as amended.

2. The Nuclear Energy Decree, 12 February, 1988/161 as amended.

3. The Treaty on the Non-proliferation of Nuclear Weapons INFCIRC/140 (FTS 11/70).

4. The Agreement with the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article III, (1) and (4) of the Treaty on Non-Proliferation of Nuclear Weapons (INFCIRC/193), 14 September 1997. Valid for Finland from 1 October 1995.

5. The Protocol Additional to the Agreement between the Republic of Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, the Hellenic Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of Netherlands, the Portuguese Republic, the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article iii, (1) and (4) of the Treaty on Non-Proliferation of Nuclear Weapons, 22 September 1998. Entered into force on 30 April 2004.

6. The Treaty establishing the European Atomic Energy Community (Euratom Treaty), 25 March 1957:
   - Regulation No 5, amendment of the list in Attachment VI, 22 December 1958
   - Regulation No 9, article 197, point 4 of the Euratom Treaty, on determining concentrations of ores, 2 February 1960.

7. Commission Regulation (Euratom) No 302/2005, 8 February 2005

8. Council Regulation (EC) No 428/2009 setting up a Community regime for the control of exports, transfer, brokering, and transit of dual use items.

9. The Agreement with the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy (FTS 16/69). Articles I, II, III and X expired on 20 February 1999.

10. The Agreement with the Government of the Russian Federation (the Soviet Union signed) and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy (FTS 39/69). Articles 1, 2, 3 and 11 expired on 1.12.2004.

11. The Agreement between the Government of the Kingdom of Sweden and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy 580/70 (FTS 41/70). Articles 1, 2 and 3 expired on 5.9.2000.

12. The Agreement between Sweden and Finland concerning guidelines on export of nuclear materials, technology and equipment (FTS 20/83).

13. The Agreement between the Government of Republic of Finland and the Government of Canada and Canada concerning the uses of nuclear materials, equipment, facilities and information transferred between Finland and Canada (FTS 43/76). Substituted to the appropriate extent by the Agreement with the Government of Canada and the European Atomic Energy Community (Euratom) in the peaceful Uses of Atomic Energy, 6 October 1959 as amended.

14. The Agreement on implementation of the Agreement with Finland and Canada concerning the uses of nuclear materials, equipment, facilities and information transferred between Finland and Canada (FTS 43/84).

15. The Agreement between the Government of Republic of Finland and the Government of Australia concerning the transfer of nuclear material between Finland and Australia (FTS2/80). Substituted to the appropriate extent by the Agreement between the Government of Australia and the European Atomic Energy Community concerning transfer of nuclear material from Australia to the European Atomic Energy Community.

16. The Agreement for Cooperation with the Government of the Republic of Finland and the Government of the United States concerning Peaceful Uses of Nuclear Energy (FTS 37/92). Substituted to the appropriate extent by the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy with European Atomic Energy Community and the USA.

17. The Comprehensive Nuclear-Test-Ban Treaty (FTS 15/2001). This treaty was ratified by Finland in 2001, but will not enter into force before it is ratified by all 44 states listed in Annex II of the treaty.